The Science Teacher

DECEMBER

See Page 4 (Courtesy Harold R. Stamm)

Featuring —

Health Education
Safety Education
Inorganic Chemistry
Science Clubs
Science Projects
Nature Study
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Teacher Training
National Defense

A National Service Journal

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Functional Health Education

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IF THE SCHOOLS expect to fulfil one of their main functions, health education must become an integral part of the curriculum. This type of education has suffered because many teachers fail to see that knowledge alone may not change the health behaviorism of the individual; and because many school systems use badly conceived and artificial health devices for motivation which probably have little educational value.

Since the individual's health affects his learning, it is evident that the school should obtain a knowledge of his health status so that specific instruction may be given. Such an approach requires the cooperation of the home and the school. The school through its health service department and through parent interviews can secure a general inventory of the individual's past and present health that provides information from which education may proceed.

Health education must be continuous throughout the whole school program in a hygienic school environment with appropriate programs for socialization and recreation. Both the recreational and socialization programs are essential to the health instruction of the school if they are well organized and functioning programs. The recreational programs should include varied activities adaptable to age groups and interest levels. The socialization program, now poorly developed in many schools, should provide for varied social activities, such as parties, assemblies and administrative controls which meet the interests and social needs of the participants. So long as these are disregarded, schools are overworking one of their best agencies for developing mentally healthy boys and girls.

AS INTIMATED previously, the efficiency of a health program is influenced by curriculum and instructional practices. First, the compartmentilization of subject matter relegates instruction to perhaps a few teachers in the science department which tends to make other teachers feel that they have no supervisory responsibilities and thus refrain from any active participation in furthering this type of education. For example, the health teacher may teach students the serious effects of colds while other teachers totally disregard the matter in their own classes by allowing cold infected students to contaminate others and the teacher himself by remaining in school to spread colds among his pupils. Compartmentilization has so imbued teachers with their own subject matter area that they fail to see the implication of other subject matter areas to their classroom instruction. Compartmentilization tends to foster "piece-meal" education so that teachers may never see the individual as a whole, living organism which is essential if effective learning in any class is to take place. Secondly, teachers tend to begin health instruction by using text books which in the majority of cases never begin with the health needs of the student. Therefore, in order to motivate such learning, teachers have had to seek

artificial devices to bribe students to assimilate subject matter. Such ill devised programs require boys and girls to make health posters, write health stories, read fairy tales, and give health plays which in many instances seem foolish to children. Though these provide for a change in activity in routine learning, it is very doubtful whether such artificial motivation ever provides an opportunity for a genuine experience which influences the individual's behavior. In this same catagory may be placed various kinds of health drives and prizes. Why not make health education a continuous process rather than an intermittent and sporadic one and utilize instructional procedures that recognize the health needs of our school population? Thirdly, if boys and girls are to grow up with healthly bodies, mentally and physically, they should be surrounded by a healthful environment. Badly lighted, heated, ventilated and unattractive rooms are poor places to teach health education. Such an environment together with the use of unsound psychological methods and prescribed curriculums for all, regardless of physical and mental needs, probably indicates the reasons for the ineffective health instruction in so many schools.

WHAT CAN the school do to give more effective instruction? Many recommendations may be offered but only a few can be mentioned within the confines of this article.

First, the health status of each child should be obtained by the school nurse or physician. A yearly physical examination is not sufficient. It must be followed by specific instruction and a later check-up with the student and his parents to ascertain any improvement in health or the maintenance of well established health habits. This requires a health staff that has time and training for this type of education development. The health officer should be one who is educated to give guidance in establishing good mental health habits as well as physical ones.

The results of the health inventory should be compiled. This may serve as a basis for the subject matter content in the general science, hygiene and biology classes. Such inventories reveal, for example, that many students drink an inadequate amount of water, have digestive disturbances, use patented medicines, eat inappropriate food, eat irregularly, sleep restlessly, have difficulties in getting along with others, and need immunization for many of the common diseases. What other sources can give more psychological sound educational material to give direction to instruction?

THE HEALTH officer should be a member of the teaching staff to give the istruction which it seems best for him to give. For example, if immunization is to be given to a group of students, the health or science teacher may give the necessary instruction concerning the need for immunization, kinds of immunization substances, the effects on the body and reasons for the fear of immunization expressed by many people. The health officer, doctor or nurse, may then come in and talk with the students on the methods of giving immunization and interview parents to secure their consent.

The health program should be an essential part of the guidance set-up of the school. The school nurse or doctor should work with all of the teachers of the school. Such a person should make recommendations for subject matter content, for unit problems in the curriculum, for classroom changes in lighting and seating arrangements, give advice on instructional problems and recommend types of curricula or activities suitable for certain individuals. This requires an adequately staffed personnel equipped with medical information and the necessary educational viewpoint.

The recreational program should be organized to suit the body needs of the students instructed. Junior high school pupils, for example, need a variety of physical activities and those especially

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The Training of a Chemistry Teacher

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THOSE WHO become chemistry teachers in high schools have a definite interest in the subject and nearly all have majored in the subject. As they begin teaching, they will try to teach their pupils in the secondary school very much as they have been taught in the college. They will imitate certain of their college teachers. This tendency will persist for a period of about five years, depending on the practical common sense of the individual concerned. Consequently, the secondary school teacher reflects the qualities of the college teacher.

The college teacher should be a past master in this art. He is old enough and has the experience to have reached the goal of real efficiency. Only a minority have so arrived. The faulty types are numerous.

There is the kind who evidently believes that there is magic and wisdom in his way of lecturing. He tolerates no questions, holds no informal discussions but will condescend to elaborate if concerned. According to Shakespeare, he says, "I am Sir Oracle. When I ope my mouth, let no dog bark."

THEN THERE is the kind who spends the first two sessions detailing you with a long list of authorities which you perforce must copy and religiously read even though it takes all your nights and Sundays to pass your mind through them once, to say nothing about digesting them. Apparently you exist only for his erudition. Cowper's verses sing his refrain:

"I am monarch of all I survey,
My right there is none to dispute;
From the center all round to the sea,
I am lord of the fowl and the brute."

The research type of teacher is a necessity, but when research becomes an end in itself and reckons not with the necessities and purposes of daily life, then schooling with such an individual has a petrifying effect. The better purpose is "Better things for better living through chemistry." This is the slogan of those who serve mankind instead of worshiping the means of serving him.

AT GREAT length other types could be described, but let us turn our attention to those who exhibit the more desirable qualities. The "Mark Hopkins on a log" type are those who have time to have a personal interest in you for what you may be. His greatness lives on in your continuing life. Those who are torchbearers to the race have the real essence of humanity.

Pres. Wm. DeWitt Hyde of Bowdoin College expresses this in the closing part of the "Returns of a College Education." "To form character under proprofessor who volubly declared to his type of this was the state university professor who volubuy declared to his classes "There is no God." He would infect you with his personal virus. Dr. Karl Guthe of Iowa was not a member of any church, yet I heard him declare, "From my study of science, I know there is a God."

SOME YEARS ago, the Division of Chemical Education of the American Chemical Society held a symposium on the training of a chemist. Dr. Rose of the du Pont organization was the chief speaker. The really important idea was made plain when chemists from different stations in life detailed their experience. Hardly any were now working in the field in which they had majored in the university. The American free field of opportunity gave them openings in other fields which they entered. All the previous talk about WHAT the beginning chemist should study sank into

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THE SCIENCE TEACHER

201 North School Street, Normal, Illinois

A Journal of
The Illinois Association of Chemistry Teachers
The Illinois Biology Teachers' Association
Indiana High School Chemistry Teachers' Association
Texas Science Teachers' Association
And Serving Other Science Associations

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WELCOME, TEXAS

We are very pleased to announce that Texas has taken action similar to other states in making The Science Teacher its official science teachers' journal. The action was taken by the Texas Association of Science Teachers on November 22 at its Austin meeting and was adopted by a unanimous vote. Mr. W. A. Betts of Austin High School, Austin, Texas, was chosen as a member of the editorial board and will serve to edit material for publication from that area. Miss Greta Oppe of the Ball High School, Galveston, Texas, is treasurer of the association and Mr. Jack Hudspeth of the University High School is president.

We heartily welcome Texas science teachers in their new relationship with us and trust that they will find the association with other states through the journal both stimulating and helpful. We hope they will find our service satisfactory and will help us improve it.

It may not be amiss here to state that our objective as a group of workers interested in the advancement of science education is to produce a service journal in the area that is worthy of the name. We expect the journal to serve the interests of the associations and their members as far as possible. As a part of this service, we attempt to strengthen associations and build up their membership by stimulating interest among teachers in association work, giving their work greater prominence, and publishing papers presented on association programs. We also endeavor to give national recognition to worthy state work.

OUR FRONTISPIECE

For our frontispiece we are indebted to Mr. Harold R. Stamm of West Allis High School, West Allis, Wisconsin. It shows a boy with a telescope he has built silhouetted against the moon. The photograph of the moon shows what can be seen through a telescope built as student project in high school.

The Science Teacher and Safety Education

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THROUGH the operation of the motor car the American public has become conscious of the problems of traffic. So often has traffic safety been brought to the attention of the individual that many have associated safety chiefly with traffic problems. However, there are more non-traffic accident than traffic, and it is the non-traffic field in which the science teacher has a fine opportunity of giving instruction which will lessen human suffering and death.

There can be no more practical application of scientific principles than that which tends to promote safety. The biology teacher can find abundant opportunities for such instruction without going outside his field. The public health movement is basically a safety program. Water and sewage treatment, ventilation of public buildings, eradication of insects and rodents, street cleaning, vaccination and the use of antibodies, measures to protect milk and other foods, these and many others are practical biological problems which give the teacher an excellent opportunity to teach public safety in its larger aspects.

The physics teacher can find numerous opportunities of vitalizing his instruction if he will give attention to safety measures. Many of these, such as the safe use of electrical appliances, he can teach right in the class room or laboratory. Is the domestic science pressing iron properly wired and does it have a pilot light in circuit? Coefficient of friction becomes real when applied to the problem of slipping rugs on varnished floors. The stairs as a kind of inclined plane offer opportunities for safety instruction when thought is taken of width of tread and height of risers. Falls in the home are a most frequent cause of serious accidents.

AGAIN, THE use of machinery, both the light home appliances and the heavy machinery used in agriculture and in other industries, offers the physics teacher a fertile field for safety instruction. What is a safe speed for operating a grinding wheel? What is the relation of gas temperature and pressure and what care should be exercised in such cases? Is the wringer on the family washing machine protected by the necessary safeguards and are they workable? Are the tractor, the harvester, and the corn husker properly provided with safety devices and does the operator exercise due care in the use of these machines? The mechanization of farm work has brought an awful toll of maimed bodies because safety measures and devices were not insisted on. Modern agriculture has come to be a hazardous occupation. During the quarter of a century that the National Safety Council has led and inspired safety movements the industrial accident rate has markedly declined. There is at present no such organization promoting safety on the farm and here is the opportunity for the school in rural community to render a needed public service.

THE CHEMISTRY teacher has a wonderful opportunity to teach safety. Fire was man's earliest and most important chemical discovery. Out of hand it becomes a devastating agent. Safety demands that intelligent means be used for controlling it. How does water extinguish ordinary fires? How does the acid-soda fire extinguisher operate? Has the pupil ever operated such a device? Can he do so intelligently in an emergency? How control oil fires? How light

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The Renaissance of Inorganic Chemistry

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LIKE MANY other fields of endeavor, chemistry has gradually broadened out to such an extent that specialization in some branch has become necessary. Up until the turn of the 20th century it was still possible for one individual to comprehend all of chemistry and to call himself a chemist without specifying his particular field of interest. Today, we recognize inorganic, analytical, organic, and physical chemistry as the four main branches of chemistry. In addition, there are such special fields as physiological, sanitary, optical, food, petroleum, colloid, geological, minerological, x-ray, plant, ceramic chemistry and many others. It has become next to impossible for any one scientist to keep abreast with the developments in all of these and numerous other fields. The situation has become still more complicated by the fact that other branches of learning have recognized the importance of chemistry and have applied chemical facts and theories to their own problems.

Greatest emphasis has been placed in the last fifty years on the development of organic chemistry — and properly so. The chemistry of carbon is in many ways of vital importance to man — to an understanding of life and life processes, whether these be in the plant or animal kingdom. In an effort to understand and duplicate the feats of "living nature," the chemist has delved into the chemistry of such substances as foods, vitamins, hormones, alkaloids, cellulose, rubber, silk, natural gums and resins. First, it was a question of scientific curiosity; now such studies have as their object the technical production of substitute materials, superior in quality and usefulness to those which nature furnishes. Mankind finds itself at the beginning of a chemical age in which the chemist is playing an increasingly important role. Among chemists, it is the organic chemist who has contributed to the greatest extent in freeing man from the material limitations of his environment.

THIS DOES not mean that no progress has been made in other fields of chemistry. Quite the contrary is the case. The field of inorganic chemistry long ago was subjected to specialization. Inorganic chemistry once embraced every thing except carbon chemistry. Today, inorganic chemistry furnishes the basic body of facts and theories in such special fields as metallurgy, ceramics, sanitary chemistry, colloid chemistry, geochemistry, agricultural chemistry, and last, but most important, analytical chemistry. These have also in turn suf fered subdivision, but this is clear — inorganic chemistry is an inclusive field, whose importance cannot and should not be undestimated.

Just as the organic chemist attempts to duplicate the feats of living nature, so the inorganic chemist is now improving upon the inanimate materials found in nature. Of course, man has been improving on nature ever since he learned to use a source of heat other than that furnished by the sun. Heat made possible the production of iron and bronze which were used thousands of years ago in place of flint, bone, and stone for the making of implements. Metal objects were prized because of their greater durability and strength. The ceramic industry began at an early age in the development of man with the discovery that fire could convert sticky clays into hard, strong materials. It is significant, however, that no startling advances in many of these fields occurred through thousands of years in the history of man until recently — that is, until investigations and studies of the fundamental

chemical constitution of these materials, and of the reactions occurring in these age-old processes were undertaken.

LET US CONSIDER what some of the significant technical advances in inorganic chemistry have been. It is only by such a review that we can appreciate what inorganic chemistry has contributed to life and living.

During this time numerous metals have been added to those commercially available and in every day use. New processes for the treatment of ores have made such elements as tantalum, columbium, beryllium, barium, cesium, zirconium, and indium available either by themselves or in the form of alloys. It is significant that these metals are in most cases derivable from complex minerals where chemical concentration of the ore values is necessary before electrolytic or chemical reduction can be effected. During this same time improvements have been effected which have made sodium, magnesium, and aluminum cheaper materials. The electrodeposition of chronium became a commercial process only thirteen years ago. Its success spurred investigation in the field of metallic coatings culminating in the development of methods for plating bright deposits of nickel, zinc, cadmium, and copper.

A wide variety of iron, aluminum, magnesium and lead alloys has been developed to give materials which are designed to satisfy practically any required physical characteristics.

The chemistry of silicates as applied to glass has led to the development during this time of borosilicate glasses (pyrex), fused quartz, hardened glass, and glass brick for structural and ornamental purposes. New cements, such as the quick-hardening high alumina cements, have come into widespread use. Countless new ceramic materials, ceramic colors, glazes, and enamels have been developed.

AGRICULTURE has been benefited by the development of the Haber synthetic ammonia process which makes available to man the inexhaustible reservoir of nitrogen of the atmosphere. No single chemical process has had as profound an effect politically and economically as this method of producing ammonia from hydrogen and nitrogen. No longer is it necessary to depend upon a single world source of nitrates in Chile for nitrogenous fertilizers. Every nation possessing a well- developed chemical industry is capable of supplying its own soil nitrogen requirements. Nitric acid, so essential to the whole chemical industry in the production of explosives, lacquers, solvents, etc., is now made almost exclusively in this country by the oxidation of ammonia. Indeed, the modern chemical age can be said to have begun with the introduction of the Haber process in 1913.

The emergency of the First World War led to the study of possible sources of potash in the United States. Since that time the Serles Lake brines have furnished a large portion of the domestic potash requirements — but only after a careful chemical study of these brines in order to make possible the extraction of the values contained therein. Thus, the synthetic ammonia process, together with domestic sources of potash and phosphates have contributed towards and made secure the food supply of this nation — in spite of everything which some of our legislators and those deluded exponents of an economy of scarcity may attempt to do.

Both the inorganic and the organic chemists have further safeguarded our food supply by the development of insecticides and fungicides. Arsenic, sulfur, fluorine, and copper compounds are still the most widely used pest control materials.

IN TWENTY-FIVE years, the demand for chlorine increased to such an extent that the electrochemical process, developed during the World War, is no longer completely satisfactory from an economic point of view. Is it any won-

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Starting a Successful Science Club

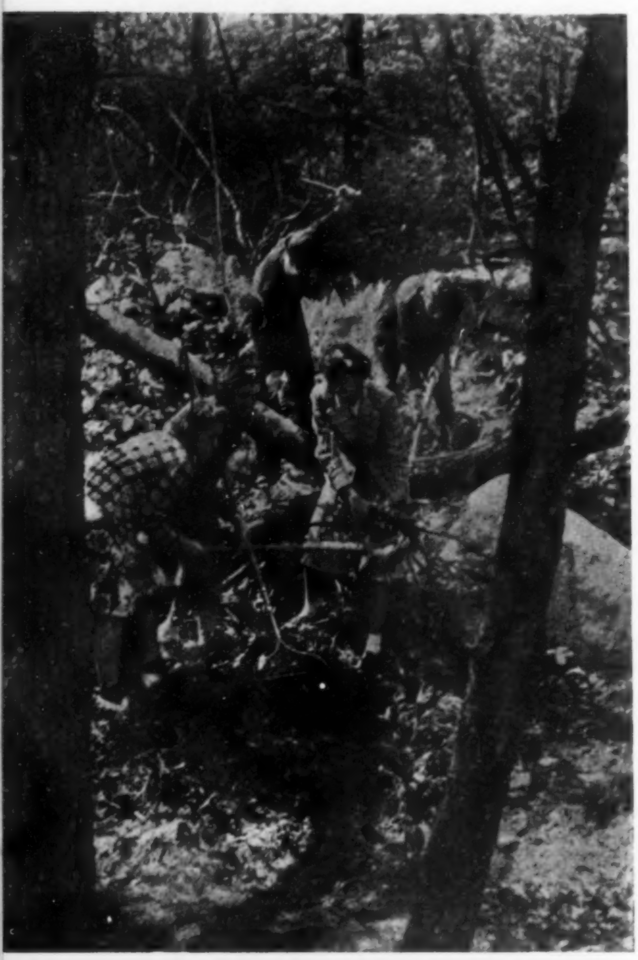
HELEN WHITTIER

Gardner High School

Gardner, Massachusetts

THE NATURAL Science Club, when started in our high school in September 1939, was an experiment. Although I had never engineered an enterprise of this sort before, I was definitely of the opinion that the work of such a group would have its chief value in a tie-up with the environment in as many ways as possible.

From several viewpoints I find that Gardner is a town well adapted for such a program. Its school of 1,000 is large enough but not too large. It is situated in a country district of hills and woodland and it not too far from the large centers of population.



Clearing way for nature trail

As the work of the organization began to take shape, it formed itself into two large programs, which included a number of minor interests. The two larger ideas are the making of a nature trail and a study of the physiography and glacial formations of the immediate region. Ech of these projects will take a school generation; but a definite unit is laid out for this year's work.

From the city we were granted the use of 47 acres of wild land for our trail about one mile from the school. Unfortunately, the timber on the land had been downed by a hurricane, and later logged off, but it was still the best of any of the tracts of one-time woodland offered us by the park and water departments. There does remain the hardwood growth, some smaller conifers, a swamp and a good patch of laurel, in addition to the smaller plants and shrubs. There are a few boulders and some excellent stumps showing annual rings.

WE WORKED with axes and rakes one afternoon a week for ten weeks clearing off the brush and laying out the trail to wind around among the points of interest. By the time snow fell we had completed a quarter mile unit. During the winter months the members worked on the labels, which were painted on 6" x 8" backs, and made them ready to go up for the specimens we were able to identify the previous November. Of course, when spring opened up there were many new plants to discover. We hoped to have this quarter mile stretch of the trail ready for inspection in May.

Our study in physiography was of real interest because in Gardner we are particularly fortunate in being in an area where evidences of glacial action are varied and plentiful. My original idea was to conduct a series of trips to nearby physiographic formations, but I discarded this in favor of a work sheet and list assignments. These assignments were chosen by members in pairs, and each consisted of a visit to be made (full directions were given), photographs to be taken and an essay to be written. These subjects included: a drumlin, glacial lakes, a monadnock, peneplain, glacial scratches, exposed bed rock, transported boulders, stratification of soil, uptilted and faulted rock strata, a sand bank, talus, pinnacle (the pinnacle washed away too soon, however), an eska and a kettle hole.

OUR COLLECTION of geologic subjects and pictures was added to by a club member who discovered a local bed of fossilized leaves, containing also some perfect cones, and even an insect pupa.

This whole unit of work was to be made into a cooperative lecture with lantern slides, as well as into a small book. We hoped to have this program in shape to give in June.

Gardner lies in a narrow strip of territory between two larger areas which have been of great interest to the geologists and which have received much study, but this area itself has been passed by the professionals, so that there is very little written information available to the novice in the field.

Our delight therefore can be imagined when we made the acquaintance in a neighboring town of a young amateur physiographer and paleontologist. With his collections, he provided us an evening program and went into careful detail regarding the formations in this region, which he knows thoroughly. His offer to conduct a geology hike in the spring was, of course, met with instant enthusiasm.

Placing marker on nature trail

OTHER IRONS we had in the fire were as follows:

1. A lesson in grafting apple trees. We had a few healthy trees selected, and planned to secure the scions and enlist the interest of some local pomologist.

2. A display of mounted birds which we had as a loan collection. We expect to have a series of these. Our biology department had only seven specimens. A committee worked on an early autumn habitat group of fresh water birds to be shown in the main corridor near the front door. Here on the floor a canvas was covered with rocks, tall grass and cat tails to represent a lake shore.

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Science for Society

EDITED BY JOSEPH SINGERMAN

A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Science Teaching and National Defense

WHAT IS OUR function, as science teachers of youth, in this period of stress? We are a nation at war, economically. (I hope we do not go beyond that stage; though possibilities are apparent).

Dr. Harry W. Chas, Chancellor of New York University, recently stated:

> "But the greatest service of colleges and universities in time of emergency as in time of calm will continue to be what it has always been, that of doing as effectively as possible the job they are always about, that of helping to train citizens of intelligence and goodwill for life in the democratic states."

If we accept this principle for education on the university level, it applies doubly to education on the secondary level. Therein lies our most difficult problem for the future. Science will occupy a prominent position in the technology of war. And, there are indications that all the mental and emotional stresses of the period will be intensified to an unprecedented, high pitch that will make it increasingly difficult for the science teacher to keep to his charted course. He will marshal all his powers of judgment and clear thinking to hold the sail ropes against treacherous gusts of emotion.

Preparation for the Future

WE SHOULD remember that we are preparing people for the future of America, the America that must go on after the war. Science can serve this purpose in two ways: by providing a method of progressive thinking and planning and by making possible a full realization, among the population, of our potential wealth. We have the knowledge, and we can develop the skill to produce radios, clothes, health, food and amusement on a scale hardly dreamed of. But this should not be done without scientific thinking and proper planning so that the skill of workers, half starved, does not again deteriorate while piles of food are left to rot.

An official medical report[1] from a certain area tells us that half of its voluntary recruits for the armed forces have recently been rejected as physically unfit—unfitness mostly preventable. At the same time, industry proclaims a dire need for efficient workers, trained technical workers, mechanics. For some years past, we have been permitting citizens to deteriorate, morally, physicaly, technically. That is what unemployment, dependence on relief, has done to them. Now, in a sudden emergency, there is a hustle and bustle to revitalize special retraining schools for skilled workers. For this, public money flows freely. But you cannot produce a toolmaker in six months or in a year. Would we not be better off today if, in place of a fettered federal work program, we had, during the past decade, a forward-looking education and work program wherein every able-bodied worker, after proper training, was provided with full time, productive, remunerative work opportunities?

Science Must Plan the Future

THE HOPE of democracy lies in the freedom of self-criticism. We will examine our past mistakes in order better to be able to plan for the future. Intelligent planning will stem from training in science and in scientific thinking.

Our youth, who hold the future in their hands, will pass from our schools into a post war world. Will our demobilized army of men, from defense and allied industries, and possibly also from

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A Method of Teaching Weather Prediction

E. W. BAILEY

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MOST COURSES in General Science include a unit on weather and climate. This is one of the most valuable of all the units from the standpoint of scientific method and practical values, but quite often it is left, so to speak, "up in the air." By this I mean that the weather factors, such as pressure, temperature, and humidity, are presented in such a way that their interrelationship is not clear.

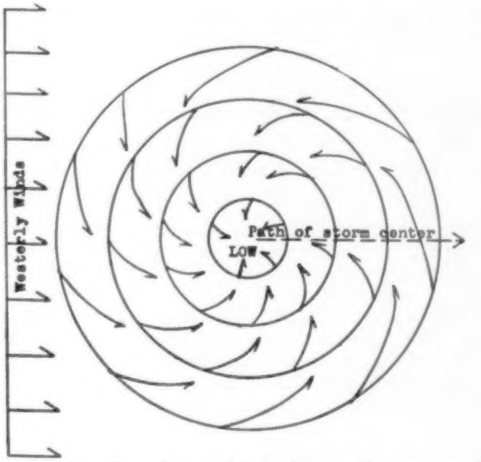
It is possible to a certain extent, to indicate to freshman science students, the most marvelous part of science — namely, prediction. The unit on weather offers an easy approach because the materials for observation are always present. It is only necessary that proper measurements and records be kept, and that the theory be well taught before the practice begins. The author has used the following method of drilling in the fundamentals of weather prediction:

First: Cover the text material thoroughly.

Second: As a review, draw an outline map of the United States on the board, with a "Low" region centered in Illinois. Place a cross, marked "A," just outside and northeast of it; and another, marked "B," outside and southeast of it.

Third: Copy this paragraph, which is from the U.S. Weather Bureau publications, on the board: "When the wind sets in from NE and the barometer falls steadily, a storm is approaching from the SW, and its center will pass near or S of the observer, with wind shifting from NE to N to NW, and the barometer will rise."

Fourth: Have the class explain, point by point, why each of the above statements is true. The paragraph contains eight facts, the reasons for which are apparent from the theory. It is at once seen that the paragraph as it is written



Movement of cyclone. Students may be arranged to fit above pattern.

is a weather prediction for an observer at "A." It should now be rewritten by a student for an observer at "B."

FIFTH: When these elementary principles of prediction seem clear to most of the class, the whole thing can be made clearer by an activity drill showing vividly how the storm moves. Take the class to the football field or campus. Have them line up and "count off" by fours. Select one to be "It." "It" stands in the center of the football field, holding a wooden or paper arrow. Number ones form a 20-foot circle around him, number twos a 40-foot circle, number threes a 60-foot circle, and number fours an 80-foot circle. When the instructor blows a whistle, "It" points his arrow upward, showing an upward current of air; the others move slowly toward him, turning slightly to their right, showing the path of the surface winds. As they approach the center the whole group should form the typical counterclockwise whirl of the cylone. Repeat the drill until it is well done.

THE SECOND drill shows the cyclone drifting toward the east under the influence of westerly winds. Have class

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Science Clubs at Work

EDITED BY KARL F. OERLEIN

State Teachers College California, Pennsylvania

A department devoted to the recognition of the splendid work being done by the science club members and their sponsors in the various State Junior Academies of Science. Material for this department, such as student made projects; demonstrations and posters; outstanding club programs; state and regional meeting announcements; should be sent to Dr. Oerlein.

The Geiger Counter

RICHARD D. JONES

Johnstown Central High School Student Johnstown, Pennsylvania

Editor's note: Richard Jones presented this paper and his counter at the Pennsylvania Junior Academy meeting in the spring of 1940. As a result he was elected to receive the AAAS Junior Honorary Membership Award for 1940. Richard also received a four year scholarship in physics at Washington and Jefferson College, where he is now a freshman. Miss Sophie Moils was his physics teacher. Richard says he intends to become a research physicist.

THERE HAVE always been many scientific problems and questions for us to solve. One by one, we have answered some of these questions, only to find a hundred more to take their place. In just this manner, the study of radioactivity has progressed rapidly in modern times, for the more deeply we delve into this science, the more we find to learn. The results of the study of radioactive radiations have led scientists to a great mystery — the mystery of the cosmic rays.

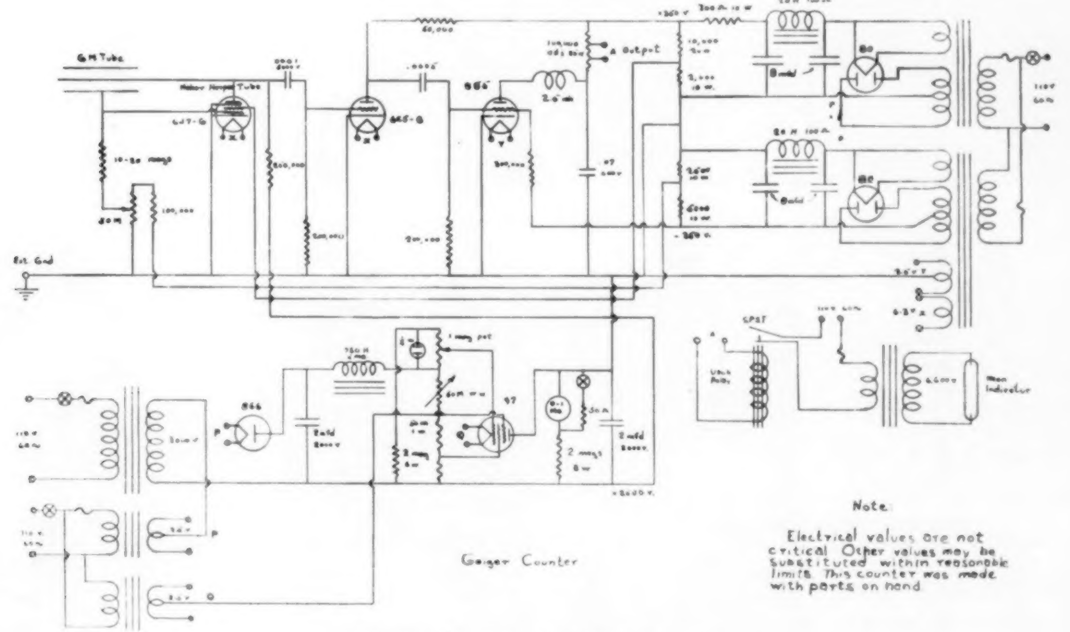
It is interesting to note that the discovery of cosmic rays was the result of an unaccountable loss of charge in electroscopes, no matter how many pains were taken to insure good insulation. In 1900, Geitel in Germany and Wilson in England formulated the hypothesis that radioactive radiations from unknown sources were responsible, while Ernest Rutherford discovered that a plate of lead two inches thick reduced the strange leakage by thirty percent.

IT WAS Richardson in 1906 who advanced the theory that the radiations did not come from anywhere on the earth, but from some place beyond the earth, such as from the sun or some other star. As a result of the tremendous interest taken in these radiations, a new method of detecting the rays was needed. In 1908 Rutherford and Geiger discovered a more convenient method of detecting radioactive radiations than by an electroscope. This method is known as the electrical method and uses a device known as the Rutherford-Geiger counter, consisting of a cathode, a thin metal tube, and an anode, a fine metal wire mounted in the axis of the tube. The electrodes are mounted in a glass

Richard Jones and his Geiger Counter

tube, containing a gas at reduced pressure. Gases commonly used were helium, argon, or even air. When a charged particle, such as a cosmic ray, passes through the tube, it ionizes the gas and the ionization is magnified several thousand times by a strong electric field maintained between the electrodes. The event is then detected, amplified and a relay is tripped much like the trigger of a gun.

As UP TO this time, we have not considered the nature of the rays, now it



Wiring diagram of Geiger Counter

is proper for us to do so. We may consider each ray as a small particle, bullet-like, having tremendous energy. There are several different kinds of particles bearing different charges, each particle having its own particular name. The energy each particle possess is great enough for it to smash or destroy any object which is in its path. When I say this, a question immediately comes to your mind — If the radiations are so powerful, why do they not destroy us as well as destroy everything else? This question may be answered in two ways. First, we may think of ourselves as mostly empty space and that the actual matter (electrons and protons), of which we are made up, might be squeezed into a thimble. Thus it is easy to see that cosmic rays pass through us without hitting atoms, just as comets pass through the solar system without destroying any of the planets. A second answer to this question is that there is a thick layer of ionized air above the earth that prevents the radiations from coming too strong. Thus the frequency with which the rays occur is slowed down.

Now the world is beginning to realize the great importance of this study and lately research has greatly increased on the subject (five thousand technical articles on research having been published). Likewise, the Carnegie Institute of Washington and the Bartol Research Foundation have sponsored many expeditions to different parts of the world. Scientists on these expeditions have studied radiations in all parts of the earth, including the stratosphere. Scientists who have ascended into the stratosphere have included instruments for measuring cosmic rays. At high alti-

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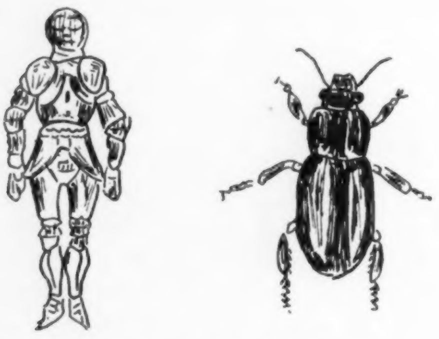
Nature The Inventor

ROBERT WRIGHT

Uniontown High School Student Uniontown, Pennsylvania

Editor's note: Robert Wright is 16 years old and a member of the Biology Club of the Uniontown High School, Uniontown, Pennsylvania. He was a junior last year when he wrote this interesting comparison between man's inventions and the animal world. The sketches are his own and were drawn on frosted glass lantern slides and projected before the audience as he spoke. The sponsor of the club is Mrs. Anna Conn.

WHY ARE SUCH people as Edison, Whitney and Watt so famous on the pages of history? Of course, the answer is that they were famous inventors. I will try to show you how some of the modern day inventions were employed thousands of years ago, not by man, but by certain animals lower on the scale of life than the human.



Armor is not original with man

For my first example, I will mention the submarine. Truly, it is a modern invention, but the fish were on earth millions of years before man. You all know that the submarine rises and submerges by use of airtight tanks. When the vessel submerges these tanks are partially emptied of air and filled with water, and when it rises the process is reversed. However, this apparently new invention was developed in the bodies of fish millions of years ago. By use of the swim bladder, as it is called, fish are able to navigate at various depths. This swim bladder is located behind the pharynx and along the dorsal side of the body. It is filled with gases and acts as a stabilizing organ in much the same manner as the tanks in the submarine.

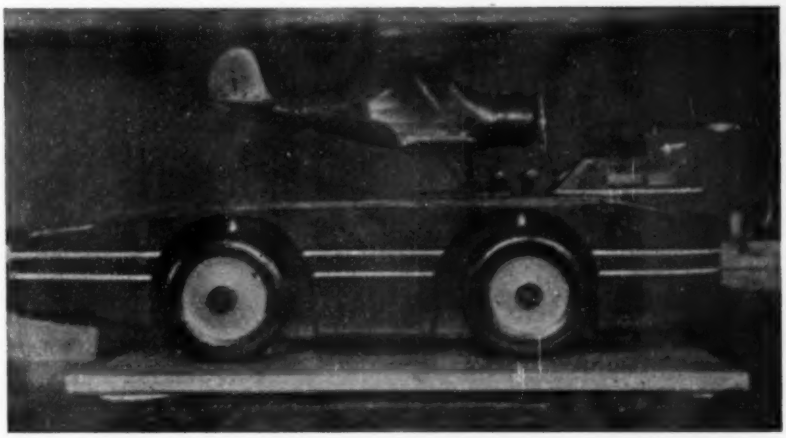
ANOTHER EXAMPLE is the armor plate which was used by the early knights of King Arthur's Court. These steel suits were used as protection while at war. If you have examined insects, especially beetles, you have noticed the very hard material, called chitin, which perfectly covers the body of the insect and gives as fine protection as did the armor of the knights. However, the insect gets protection at all times and does not have to worry about its removal.

In India and some other Asiatic countries, we find a most interesting little bird having the same occupation as thousands of people in the world today. that is, being a tailor. This bird in making its nest sews together a large leaf or two much in the same way as you put on a patch. Filled with straw or grass, this little bag makes a very good little home.

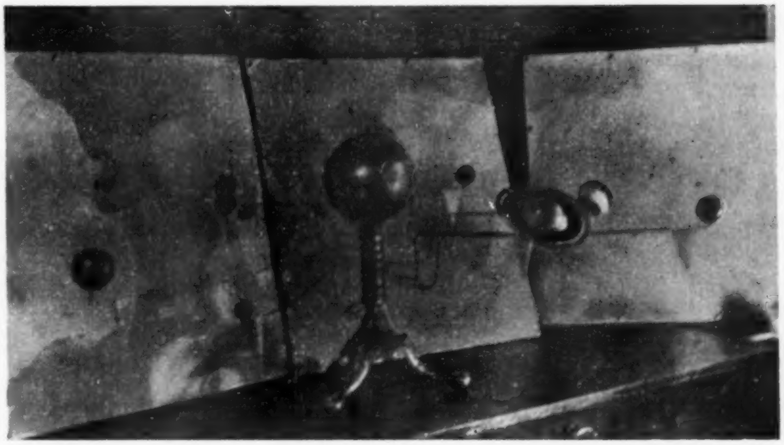
Firefly suggestive of lighting improvements

Probably one of the most efficient lighting systems in the world is possessed by the firefly and glow worm, with their phosphorescent light. If you

Some Exhibits of Iowa Junior Academy of Science Displayed at April Meeting, 1940



Model of Admiral Byrd's snow cruiser. Built by the Science Club of Iowa City. Cruiser is built to scale and is 48 inches long.



Planetary system. Shows relationships in size, distance of planets from sun, and the planetary movements. Made by the Scenic City Science Club of Iowa Falls.

examine a light globe, a candle flame or a gas lamp, you will notice that a great deal of heat is given off. But the mysterious firefly gives off all light and no heat. If man could discover a way to produce cold light as does the firefly, he would become rich as well as famous. Still the efforts of man only approximate the efficient light of a firefly. The ancient Aztecs are said to have put large numbers of fireflies in gourds with holes in them and used them as torches on night journeys. For centuries their light has been a puzzle to scientists but it is believed to be caused by certain chemical substances in the fat tissues which come in contact with oxygen. In the field of light and its research, there is much yet to be done.

IF YOU HAVE EVER examined the bones of chickens as they serve their purpose for Sunday dinner, you have perhaps noticed their extreme lightness.

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Correct Approaches to the Study of Nature

FATHER GEORGE M. LINK

State Naturalist, Marquette State Park — Grafton, Illinois

IT IS WELL known that, human nature being what it is, it is usually best to get people to approach a certain subject at an angle rather than too directly. This is especially true of children and of the process of training or educating them along certain lines outside the school curriculum. Not so well known is the fact that even nature study must not be expected to hold its fascination continuously. Youth must be brought around to it, particularly since most of the opportunities for pursuing this pastime occur in youth's leisure time, not in the school period. That is why it is so important to plan our approaches carefully, and according to the best psychological principles.

If one were to list in the order of importance some ten or twelve items that lead up to nature study, pure and unadulterated, he would surely go about it in some such way as the following.

To begin with, one must be aware of the fact that there are counter attractions. Just as soon as warm weather opens up, instead of the boys and girls being wild to go out and study nature they are wild to get out with baseball and bat, with rubber ball and jacks, with kites and marbles. These pastimes are not necessarily always the strongest, but they are habitual with our young people and being in possession of the field makes it nine times as hard for nature study to get in its oar. There are also socials, visits, picture shows and other amusements that take up the time, distract attention and destroy the much needed patience one must have to get at this business. Number one then on the list of proper approaches to the study of nature would be to eliminate counter attractions and to be careful to catch the fancy of youth at the psychological moment, not when it is most interested in something else.

ONE MIGHT think that games would be listed next as a good approach to the subject we have in hand. They have their appeal, and a field trip in the woods might very well begin with a couple of games for the pure fun of the thing. But nature games are educational games and who is the child that does not understand this to be so? There is something stilted, something sophisticated about the various playtime activities that have instruction in view that keeps the boys and girls somewhat away from these forms of entertainment until they become used to them; even then they must be varied considerably.

I would list, as a second principle, the keeping of pets. No other one thing can so arouse an interest in and sheer love of God's creation than the keeping of some helpless young thing and realizing how much it depends upon one for its life and happiness. Companionship with pets is an experience everyone should grow up with. When the small boys comes home with his pockets stuffed with fishing worms and the tail of a dead fish sticking out of his side pocket, it is not cruelty, certainly not intentional cruelty, that prompts him to do this cruel thing. He wants to take care of these things. He wants to watch them, see how they grow and what they do. But in his ignorance, he doubtless does not realize that an animal taken out of its proper element dies and that fishing worms may be uncomfortable in his pocket. Some curb must be put upon the desires of young people to bring everything alive into the house. But to deny them the pleasure of keeping anything at all is frightening to contemplate if we deal with proper environ-

ments in which children are to be brought up.

THIS BRINGS us to a kindred point to be observed; the keeping of pets. If there is to be success and satisfaction in keeping pets, much depends on surrounding them with as pleasant and natural an environment as is possible under cramped conditions without an over-expenditure of time and money. It is safe to say that this is quite possible with our present advance in knowledge of habitats and ecology. It is possible to set up an aquarium as a small living world in which the inhabitants are really happy and contented. This can be done with a minimum expenditure of time and money. Then there is the rearing of live foods to keep pets in good vigor and health. There are so many creatures a boy may want to raise, beginning with fishes or even insects and crabs and going on through the long list of snakes, lizards, turtles, frogs, salamanders, birds, mice, and squirrels, right on up to raccoons, and foxes. Any of these can be easily fed with a continuous supply of live food. Meal worms, which are always so acceptable to many animals, are particularly easy to grow if one has learned the trick. Such things are properly listed as approaches to nature.

Hand mindedness comes in, too, and also the collective urge as halfway stations to our ultimate aim. We would encourage pupils to make leaf prints, to pour plaster-of-Paris into molds to make animal tracks, to store shelves and museums with stones, fossils, shells, winter bird nests, woods, pressed plants, to make any of the innumerable projects that are now or have been on the market. These are all included under the heading.

NEXT MIGHT come games, a wide repertoire of them; games that teach the study of nature. There are many excellent books on this phase of the work, including William G. Vinal's "Nature Guiding" and Charles F. Smith's two books on games. Scouting is particularly happy in inventing play methods of doing real hard work. There are several good tricks and stunts that should be mentioned here like the Yankee Bird Namer and Cornell University's "Nature Helps." Stories make a close second to games; stories told around the campfire in never-to-be-forgotten moments of calmness and joyful anticipation. Even songs do their share if only to put young hearts into a receptive mood. There are songs, jingles and even poems that convey information.

Another group of helps would include foremost in the list your nature leaders. A good outdoor guide is a boon inexpressible. I do not mean a scientific naturalist exactly, though even he can arouse a tremendous interest on occasion; nor on the other hand do I mean the mere smatterer who is so sure of every thing that he blunders about any object he sees. I would desire the real, true and tried outdoor man who has used his eyes and ears to good purpose and has read intelligently. He is a treasure indeed to any nature group.

Going out on strolls and hikes comes in here very appropriately. Rambles through the woods, short excursions where so much is found, taken as often as posible after school hours or early in the morning, are real incentives to the study of nature. These hikes will give more in half an hour than is often obtained through days of work in other lines. Especially is this true under the kind of leadership described above. Keys, charts and pictures come in next. If there were time, it could be abundantly shown how these simple devices arouse and retain interest. Gradually we come to the end results towards which we have been aiming. It is true that money may be required for equipment and that considerable interest must be already there for any boy or girl to begin reading and studying books or to do such things as keep a journal or make a nature calendar. Actually

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Telescope Making Becomes a High School Project

HAROLD R. STAMM

West Allis High School — West Allis, Wisconsin

IN THE West Allis High School the phrase, "Make a Telescope," has not only become a popular one, but has in fact almost become a tradition. Telescope making was begun as a project to stimulate interest in the study of light and optics in the physics course. It has grown so that many telescopes are now being made, including some of six-inch diameter and larger.

Interest in the project was easily stimulated by exhibiting a model telescope in the class room and also pictures of planets and constellations of stars that had been taken by means of a telescope. Then when the pupils found that the task of grinding a mirror and making a scope, which at first seemed so difficult, was comparatively easy, they were eager to make their own. As a result, over thirty telescopes are now in use and more than double this number of students have been actively engaged in making them.

The problem of getting the cost of the instrument so low that pupils could afford to build them was met after considerable search through price lists of materials. It was found that a telescope could be built for as little as one dollar and fifty cents and yet be an accurate and efficient instrument. In fact, if the instrument was well made, it would permit an observer to read sign boards and even newspaper headlines one half mile away. Stars of the twelfth dimension also would be visible through it.

TO SUPPLY the large group of interested students with ample materials, it was necessary to purchase the supplies in large quantities. For example, the necessary grades of carborundum were purchased in pound lots, and pure pine pitch in ten-pound lots. The materials were weighed out into packages containing the right amount to make a complete mirror for a telescope. The packages were sold to the students at 35 cents each. Each student, or student group, doing a telescope project could work on it at home as well as at school. As they were anxious to get the work completed, most of the work was done at home.

The mirror, which is the most important part of the telescope, is ground from two glass casters of four-inch diameter such as are used under furniture in the home. These may be obtained at a hardware store and usually sell at eighteen cents per pair of two. One of these is fastened to a short board by filling it with pine tree pitch and inverting it over a circular piece of wood two and one-half inches in diameter that is attached to the board. The board is fastened to a barrel head which serves as a work bench, about which the worker may move during the grinding process. This caster serves as a tool for grinding. To the other caster a common thread spool of wood is attached in much the same way with pitch. The spool serves as a handle for the use of the worker in doing the grinding. The students then proceed with the work of grinding, one full period being spent on this work, with each student in the class taking his turn.

THE GRINDING is done by use of carborundum as an abrasive material to wear away the glass. A coarse grade, No. 80, is used to do most of the grinding, with the finer grades to finish the mirror and give it a very smooth surface. The six grades of carborundum recommended are Nos. 80, 220, 300, 400, 500, and 600. Number 600 is used in finishing the surface. Finally, after the finest grade of carborundum is used, the glass is polished by use of jeweler's rouge (iron oxide) to give it a perfect reflecting surface.

In grinding, a little carborundum moistened with a little water is spread on the surface of the glass and the upper one (to which the spool is attached) is dragged back and forth over the lower one in such a way that its center receives constant wear while the edges do not. As a result the center of the upper glass caster wears away more rapidly than the edges and becomes concave. This concave surface, when completely ground and polished, is used to make the mirror for the telescope. During the grinding the upper glass caster is rotated a fraction of an inch with each stroke while at the same time the worker moves slightly around the barrel on which the lower caster is mounted. The rotation of the mirror and the moving about, or "circling," the barrel cause the mirror to be ground with a uniform concave surface of parabolic form.

AS THE GRINDING proceeds, a careful check must be kept on the depth of curvature as a four-inch mirror in a telescope of this kind works best if its focal length is from 48 to 60 inches. This gives a 12 or 15 to 1 ratio of aperture to focal length. It is surprising how little depth of curvature is required to give this focal length. The depth of curvature of an f.12 is 0.022 inches, or the thickness of a thin dime. When the required focal length is attained, the finer grades of carborundum are used to make the surface smooth. In the final polish with rouge, a mixture of a little pitch and beeswax is spread over the lower glass surface and then sprinkled with rouge. By this means all scratches are prevented. A Foucalt knife edge is used to determine how closely the mirror fits the parabolic curve needed to give a perfect focus.

To silver the mirror the Brashear process is particularly recommended. The formula may be found in a chemical handbook. The cost should not exceed seventy-five cents. Those who prefer not to do their own silvering may have their mirrors aluminized in Chicago for about one dollar and fifty cents. This gives a non-tarnishing face to the mirror.

Whetton Gehrig and his telescope; Science Club, Flat River, Missouri

A FOUR-INCH mirror may be mounted in five-inch rain down spouting sixty inches long for a tube. For a larger mirror a stove pipe can be used. There must be sufficient clearance about the mirror inside the pipe to permit adjusting the instrument. The mirror is then mounted on a three-point suspension at one end. Six inches inside the other end of the tube is mounted a spider, which may consist of three one-eighth inch rods extending in to the center of the pipe where they are fastened together.

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Catching Vitamins on Fish Hooks

FRANK B. KIRBY

Director of Education, Abbott Laboratories North Chicago, Illinois

There is the greatest difference in the world between guesswork, and knowledge. For example, history shows that cod liver oil was used by the people of Norway, Sweden, Scotland and elsewhere way back in the fifteenth century as a cure-all for a wide variety of diseases. The fact that it had not been proved a cure-all was of little or no consequence to the people of that day.

With the passing of the "Dark Ages" however, inquiring minds began to seek for the cause or causes of the results which were obtained from the administration of cod liver oil. In the beginning, it was thought that the darkest oils with the strongest odors were the most desirable products, but this was disproved. Attention was then directed to the iodine content and subsequently to the unsaturated fatty acids, but both of these theories were found to be incorrect.

The real reason for the value of cod liver oil was not found until 1920-1921, when vitamins A and D were discovered. Cod liver oil was found to contain these two factors essential to good nutrition and health in much larger amounts than the ordinary foods. Naturally the chemical nature of these vitamins was not discovered until some years later and the first vitamin under serious study was the vitamin D.

After an exhaustive amount of investigation, Steenbock, of the University of Wisconsin (in 1926) actually made vitamin D by the (exposure) irradiation of ergosterol with ultra-violet rays. Ergosterol is a sterol found in fats (at first isolated from oil of ergot; hence the name).

This new product was named viosterol and has been and still is used by physicians and dentists in the treatment of diseases and conditions known to be due to a vitamin D deficiency in the diet — especially in the treatment of rickets.

In 1929 a Norwegian scientist, Schmidt-Nielsen, reported that halibut liver oil has fifty times the vitamin A potency of cod liver oil. This published announcement precipitated a large amount of investigation on halibut and other fish liver oils with the result that at the present time a great deal has been learned regarding fish oil biology and chemistry.

Mr. Chas. F. Lanwermeyer of the Abbott Laboratories was sent out to the great source of supply — the Upper Pacific off the coast of Alaska — to study the problems at first hand. It was necessary to determine whether or not there would be a large enough supply of first quality halibut livers to yield oils in sufficient quantities to meet the demand when the product was put on the market.

Life History of the Halibut

The halibut, when hatched, is like any other fish larva, but it soon begins to flatten out, taking the shape of a flounder. When it is about three months of age the left eye starts migrating over next to the other until both eyes are together on one side of the head. The eyed or upper side of the body takes on color, the underside remaining white, and the fish then swims white-side-down instead of upright.

The life history of this fish has been under investigation for some time. We know where it lives, where it spawns, and we can follow its growth and development to maturity and reproduction. Upon the recommendation of the International Fisheries Commission, a law has been passed prohibiting the fishing of halibut during the spawning season (between November and February).

Thus, there is little fear of the annihilation of the halibut, although they are retiring farther and farther north and are found at greater distances from shore than they were in the past.

Catch and Source of Supply

An average of 45,000,000 pounds of halibut is caught every year in the northern waters. Of this, five per cent is caught off the coast of Newfoundland and 95% off the coast of Alaska. Therefore the desirablity of Alaska as our source of supply was apparent. We also obtain livers from halibut caught in the Atlantic.

Fishing for the Halibut

The present-day halibut boat is surprisingly small for the fight against the elements. The average boat is only 40 feet long, and has accommodations for from five to eight men. Provisions to last from two to three weeks are put on board, the fishing gear put in order, the hold filled with crushed ice and a liberal amount of herring obtained for bait.

The fishing grounds are located at least fifty miles from the shore. On the way cut the crew baits the hooks — several hundred in number — and upon arriving at the fishing grounds the lines are hauled out over the side of the boat one after another, each end of the horizontal line being held down at the proper distance from the bottom by means of an anchor and connected by a vertical line to a buoy on the surface, each carrying a flag. The lines are so placed that the hooks are about six inches from the bottom. It takes several hours to set these lines. Each line has hooks placed at a distance of 13 to 18 inches from each other and the hooks are baited with pieces of herring.

When the last line has been set the boat returns to the first; here the halibut has had plenty of time to bite.

Treating the Fish

As the fishermen pull the fish up by means of a hawser, it is more or less stunned by the difference in the pressure and temperature of the water, but a knock on the head with a mallet finishes the job.

Saving the Livers

Before the demand for halibut liver oil added this important branch to the halibut fishing industry, the entrails were immediately removed and thrown overboard, and the fish packed in ice in the hold of the boat.

The job of the physiologic chemist was to show the fisherman how to carefully and quickly remove the liver from the entrails and free it from the gall bladder. After the removal, the livers are placed in clean, 40-pound tin cans on ice. In this condition they keep perfectly fresh until they reach the extraction plant in Seattle. The oil is extracted and refined in this new, modern extraction plant from the fresh livers as they are brought in to shore. It is then shipped in special containers, protected against air and light, to the laboratories in North Chicago, where it is bioassayed for vitamins A and D.

The Product

Our first announcement to the medical profession was in January, 1932. It was natural to consider haliver oil a really great contribution to A Century of Progress in medicine. In fact, this product was selected as the theme for our exhibit at the World's Fair of 1933. The first product we put out was Haliver Oil with Viosterol, a combination of vitamins A and D with Viosterol added to increase the antirachitic potency. Later we followed with Haliver Oil Plain. Then, in order to make the product more convenient to take, we offered these oils in three-minim soft gelatine capsules.

As Compared to Cod Liver Oil

The exceedingly high content of vitamins A and D in halibut liver oil as compared to that of cod liver oil, makes it possible to administer drop doses instead of teaspoonfuls to obtain the same benefit. In fact, three minims (10 drops or one capsule) of halibut liver oil are equal in vitamin A content to not less

(Continued on page 29)

The Downfall of the Sanctity of the Molecule

GEO. L. CLARK

University of Illinois Department of Chemistry Urbana, Illinois

(Concluded from October issue)

IN MOST OXIDES and sulfides electrical conductivity is caused by **deviations from strict stoichiometric** composition. ZnO conducts at 600° because oxygen has been lost, leaving an excess of metal atoms as cations and free electrons. Conductivity at this temperature decreases with increasing oxygen pressure because the excess of zinc ions and electrons is reduced. Exactly the opposite is true of Cu_2O, for excess oxygen tends to remove electrons from Cu^+ to form Cu^{++}, with increase in conductivity by electron exchange between Cu^+ and Cu^{++}.

$$\begin{array}{cccccccccccc} Cu^{++} & & Cu^{+} & & \square & & Cu^{+} & & Cu^{+} & & Cu^{+} \\ & O^{-} & & O^{-} & & O^{-} & & O^{-} & & O^{-} & \\ Cu^{+} & & Cu^{++} & & Cu^{+} & & Cu^{+} & & \square & & Cu^{+} \end{array}$$

Empty cation spaces in FeO, FeS and FeSe have been proved by X-ray analysis (Jette and Foote, Hagg).

The remarkable case of γ - Ag_2HgI_4 is considered above. In the α - form silver and mercury ions statistically fill 3 out of 4 equivalent positions. Between 40° and 50° a transformation (β to α) sets in with relatively enormous increase in conductivity as a result of disorder in which Hg^{++} ions transfer 6% and Ag^+ ions 94% of the current.

These disorder phenomena are extended to the explanation of chemical reactions of solids.

Wagner and associates have shown that oxidation or rusting of metal surfaces proceeds as a result of varying ratio of metal to oxygen, and by actual diffusion of cations and electrons from the **metallic phase towards the oxygen phase.** At an iron surface the ratio of Fe:O = 1:1. while at the exide-gas boundary there maye be as high as a 10% deficit of iron with the result that iron tarnishes more rapidly than other metals.

CRYSTALS IN WHICH MOLECULES RETAIN IDENTITY

IN FAIRNESS to the proponents of the traditional molecule it must be said that all is not lost, in spite of the evidence just presented. For there is a class of solids in which the molecule does not lose its identity in the spacial configuration. In the cases already considered, it may be noted that the bonds which hold the crystals together are of ionic type as in rock salt or homopolar or covalent (sharing of electron pairs) as in diamond or zinc sulfide or metallic (positive ions in an electron gas). These are all conducive to coordination of neighbors around a central individual in the crystal lattice. But there is a fourth principal type of bond — molecular or van der Waals — which makes it possible for electrically neutral molecules of organic compounds to lie alongside each other in regular configuration, even though these forces may be weak as indicated by low melting points and ease of sublimation. These are the molecules of the vapor state and of the organic chemists' structural formulas — flat benzene hexagons, long chains, etc. — retaining their identity, size and shape in the crystal packing; for they directly register their distinctive molecular architecture in the x-ray diffraction patterns from which are plotted contour maps of electron density. Similarly the "dumbbell" molescules of Cl_2, Br_2 and I_2 are unmistakably still present in solid crystals, held in place by the residual van der Waals forces.

AND SO, what has the downfall of the universal rigid application of traditional concepts done to chemistry? Are

(Continued on page 30)

National Committee on Science Teaching

The next meeting of the National Science Committee will be held at the Claridge Hotel in Atlantic City, February 19, 20, and 21.—Editor's note.

MUCH PROGRESS is being made in reshaping a science program for grades one to twelve according to recent reports of the National Science Committee of the National Educational Association. This committee, headed by Dr. Ira Davis of the University of Wisconsin, is doing an outstanding piece of work in vitalizing the science curriculum; bringing it into close contact with life situations; developing a program of teacher training both in service and in college; making the new science program functional; and getting together new procedures and materials of instruction for the benefit of teachers. It is important that teachers nationwide keep in close contact with the work of the committee and feel free to give constructive criticism and suggestions so that the finished work will represent the best that can be obtained at present. It is the policy of the committee to give credit in its reports for contributions sent to it.

The committee at its last regular meeting in Milwaukee, Wisconsin, in June made rather definite decisions concerning some phases of its program, particularly as to the acceptibility of some reports being prepared and also as to the publication of the material.

THE PHILOSOPHY sub-committee which has established the principles that form the basis for the whole science program, has much of its work already done and is now getting its report in written form ready for publication. In Part I of this report will be discussed "Science in Modern Living." This will include "Science in the Schools," "The Individual in a World Remade by Science," and "Science Implications of the Educational Program Recommended by the Educational Policies Commission." Part II is to cover the "Functional Outcomes of Science Instruction," which includes "Areas of Needs" and "Some Broad Outcomes." In Part III will be found the "Implications for Different Levels of Science Instruction" from pre-school and kindergarten to junior college inclusive. Mr. Nathan A. Neal of Cleveland is chairman of this sub-committee.

The sub-committee on Needs and Desirable Functional Outcomes, headed by Dr. Croxton of State Teachers College, St. Cloud, Minnesota, has revised its report in the light of suggestions made by the other sub-committees and now is completing the process of validating the material. There was some discussion of the form in which the material should be published so as to be most useful to the student, the classroom teacher, and those forming courses of study. The indications are that the work of this committee will be most stimulating as well as challenging to the alert science teacher who is anxious to make progress.

You Can Help

THE SUB-COMMITTEE on new procedures is attempting to help teachers achieve the goals set up for science education by submitting suggestive plans that have been found satisfactory in practice and that do help attain these goals. The term "new procedures" does not mean that the procedures have not been known in the past, but rather includes the best from past experience. These may be new in part to others. The work of this committee depends to a large extent on cooperation of science teachers nation wide who are willing to send in a brief description of their best methods. Every one who feels he can make a contribution should write to the committe chairman, Mr. Robert L. Ebel, Edison Institute High School, Dearborn, Michigan.

The study of teacher education made by the sub-committee in this area is

(Continued on next page)

Annual Meeting of the American Science Teachers Association

"Associated with American Association for the Advancement of Science"

The annual meeting will be held in Philadelphia, Pa., December 30, 1940, during the convention of the American Association for the Advancement of Science, in the same city.

The program is planned to include:

Morning Session:

Address — "New Types of Glass and New Techniques," Exhibits. Dr. Albert E. Marshall, president, Rumford Chemical Company.

Presentation of the Oersted Medal to an Outstanding Teacher of Physics, by the American Association of Physics Teachers.

Television — Demonstrations and Discussion. Mr. T. F. Joyce, Vice-President of R.C.A., and member of his staff.

Luncheon Session:

Address and Demonstrations — "Taste and Smell." (Materials to illustrate will be passed out between courses. Dr. Albert F. Blakeslee, President of the American Association for the Advancement of Science, and Director of the Dept. of Genetics of the Carnegie Inst. of Washington, Cold Spring Harbor, N. Y.

Afternoon Session:

Symposium — "The Place of Science in General Education." This will include such questions as: Should there be changes in content and approach? What efforts can be made to interest more students in science courses? Has national preparedness placed added responsibilities on science teachers? Speakers include: Dr. Watson Davis, Director of Science Service, Dr. Oscar Riddle, Investigator, Carnegie Institute of Washington, Cold Spring Harbor, N.Y.; Dr. K. Lark-Horovitz, Dept. of Physics, Purdue University.

All persons who are interested are invited to attend. If you would like to have one of the final printed programs mailed to you, please address the secretary, Deborah M. Russell, State Teachers College, Framingham, Mass.

NATIONAL COMMITTEE

(Continued from page 23)

nearly complete. The chairman, Professor S. R. Powers, Teachers College, Columbia University, states that his committee expects to present a complete manuscript at the coming meeting in February. The topics to be covered are the following: "Science Education in Development of America and in Other Countries. The Function of the Teacher with Competence in Science in Present Day America. The Education of the Teacher for Personally and Socially Satisfactory Living. The Subject Matter Preparation of the Teacher for Special Competence in Science. Broad Outlines of the Program for Teacher Education in Science. Suggested Programs. The Inservice Training."

The first chapter will be developed from research materials. Chapters two and five will be developed by the committee from their studies of the opinions of teachers concerning contemporary issues and of teachers' estimates of the effectiveness of their own training. The last two chapters will be drawn largely from current experience along progressive lines.

INORGANIC CHEMISTRY

(Continued from page 7)

der, therefore, that salt and nitric acid are brought together to give chlorine and sodium nitrate in an effort to produce more chlorine without at the same time producing the less desirable caustic soda? The uses of chlorine defy enumeration, but consider simply its use in water treatment either by itself, or in combination with ammonia. Here is an inorganic chemical which safeguards the health of the nation.

Bromine is now obtained from sea water and shortly will also be obtained from the Searles Lake, which, in addition to supplying potassium chloride now furnishes this country with most of its borax and boric acid. It is estimated that thirteen tons of bromine will be obtainable daily from this source. Think of it.

IODINE IS obtained from the brines associated with certain California oil wells — no longer do we depend exclusively upon Chile for this material. Fluorine was once a chemical curiosity, but is now used extensively in the elemental form and as hydrofluoric acid and numerous other compounds. It is one of Illinois' most important mineral resource and has come into its own within the last few years in the production of freon and other fluorine containing compounds.

However, a mere recital of many similar developments is not as illuminating and convincing as a consideration of production figures of some of the common every day chemical commodities. The heavy chemical industry, though well established, is continually improving its products and processes. The statistics given below are selected from an excellent survey of the American Chemical industry which was published in the September issue of Chemical and Metallurgical Engineering. Only those inorganic materials whose production, through a chemical process, exceeded 100,000 tons in 1937 are listed.

Table I

Production and Price Figures for Some Inorganic Chemicals

Chemical	**Production in tons**	**Av. value per ton**
Sulfuric acid	7,946,695	7.38
Nitric acid	175,860	86.21
Hydrochloric acid	121,473	56.18
Sodium hydroxide	961,591	35.71
Sodium carbonate	3,037,421	14.10
Sodium bicarbonate	142,161	23.37
Sodium silicate (liquid)	600,979	11.13
Sodium sulfate	ca. 300,000	ca. 10.00
Sodium phosphates	ca. 160,000	----
Superphosphate	5,003,776	10.44
Potash	486,090	19.32
Ammonia (anhydrous)	115,000	80.00
Ammonium sulfate	747,118	21.99
Chlorine	446,261	36.43
Calcium chloride (75%)	223,641	16.78
xAluminum sulfate	426,961	22.27
xLithophone	125,746	79.00

x Figures for 1938

THESE ARE some of the facts and figures which illustrate the importance of the inorganic chemical industry in modern life. Like organic chemistry, the developments of the future will concern themselves with the use of raw materials which are readily available and cheap. The organic chemist uses coal, air, water, natural gas, petroleum, cellulosic materials (wood, cotton) and agricultural products. The inorganic chemist uses largely sulfur or sulfides, air, water, rock phosphate, salt, limestone, and silica. It is the chemistry of sulfur, phosphorus, nitrogen, silicon, and chlorine which holds the attention and interest of the modern investigator in inorganic chemistry and the manufacturer of inorganic chemicals.

Nature furnished us with beautiful gemstones. Rubies and sapphires are now produced synthetically. The giant silica and silicate molecules — the inanimate polymers of nature are receiving attention in an effort to build and construct new inorganic plastics. Glass is even now spun into cloth, and bentonitic clay made into a transparent film under the name of alsafilm. An inorganic material composed only of phosphorus, nitrogen, and chlorine can be heated to produce an inorganic rubber. Who shall say that we will not be able some day

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SUCCESSFUL SCIENCE CLUB

(Continued from page 9)

3. The placement of a permanent display cabinet in a prominent area of some corridor. A committee combed the second hand stores for a show case. A little later they hoped to maintain a series of exhibits with changes every fortnight. This seemed a little ambitious to me, but it was their idea.

4. Like multitudes of others, some of us tried the vitamin B_1 for house plants.

5. A little work was started in bee keeping on the school grounds during the spring. Not more than a half dozen pupils of the thirty were interested in this, but I believe that was enough to make it worth while.

6. A trip to Boston in April to the N. E. Museum of Natural History and to the Agassiz Museum. In October we visited the planetarium at Springfield. Both trips were by bus, and were 60 miles each.

SPECIAL TRIPS during the winter were as follows:

1. One meeting was provided by a local hobbyist who explained his work in grinding a six inch lens for a telescope. We hoped to have a look through it before June.

2. At our last program meeting another local resident exhibited and talked about his collection of woods from many parts of the world, a collection on which he has been working since a boy here in high school. He gave each member, as souvenirs, a collection of eight very thin cross sections of local woods strung on a rope and plainly showing the structure.

3. We had one skating party and hot dog roast in the December vacation. A bulletin was issued a week before on the stars and planets visible on that date, and the leader made sure that each member present actually identified the heavenly bodies described.

Here follows a typical study outline. Other work sheets were issued on different topics.

Skies in the Last Week of December
8:00 p.m.

Dec. 22 1:06 p.m.—Sun farthest south; winter starts.

Dec. 26 6:28 a.m.—Full moon.

Dec. 29 6:00 a.m.—Moon nearest earth, 227,300 miles distant.

On Dec. 17 at 11:00 a.m., the moon was farthest from the earth, 251,300 miles distant.

Planets —

THERE ARE three planets to be seen in the west soon after the sun sets. A fourth planet, the brightest one, Venus, sets before eight o'clock. However, it can easily be found in the west as soon as it is dark, for its brilliance exceeds that of every other star or planet.

Next to Venus, Jupiter is brightest and stands in the figure of Pisces, the fishes, to the southwest. Considerably fainter, though brighter than most of the stars, are Saturn and Mars. Mars is in Aquarius, the water carrier, to the west, while Saturn is in Pisces. Mercury, the remaining naked eye planet, is not visible in the evening, but for a few days about the 16th of the month it will appear low in the east about an hour before sunrise.

Try to identify the following:

Constellations —
- Orion the warrior
- Taurus the bull
- Pleaides the seven sisters
- Gemini the twins
- Great Dipper, the great bear
- Draco, the dragon
  west of big dipper

Stars —
- Betelgluse and Bellatrix
- Rigel
- Aldebaran
- Castor and Pollux
- Capella
- Deneb

THE MOST brilliant stars now to be seen are in the southeast, surrounding the figure of Orion, the warrior, which can easily be identified by three stars in a row which form the man's belt. Above and to the east are two stars, Betelgluse the brighter and Bellatrix the fainter, which are his shoulders. Rigel, the bright star to the south of the belt, is in one of his feet.

Above Orion is Taurus, the bull, supposed to be charging on Orion. The red star Aldebaran, in a V-shaped group, is his eye. Still higher, in the shoulders of the animal, are the Pleaides, a group sometimes called the "seven sisters." Below Orion is Canis Major, the great dog, with the dog star, Sirius, the brightest in the night time sky. Low in the east is the lesser dog, Canis Minor, with a star called Procyon.

A LITTLE higher and farther north are Gemini, the twins, with stars named Castor and Pollux. Above them is Auriga, the charioteer, in which we find the star called Capella.

Two other stars of the astronomer's first magnitude, are indicated low in the northwest. They are the only ones remaining of the brilliant stars of summer. Deneb in Cygnus, the swan, is at the top of a figure called the Northern Cross. Still lower to the right is Vega, located in Lyra, the lyre.

AT OUR SECOND and other social meeting, members were required to bring a specimen of local rock or mineral and to give a short commentary on its formation and use. To my surprise, this program went off quite like a seminar.

A constitution was adopted at a later business meeting, in which the purpose was framed: "To acquaint further the members of the club with some of the many fields of science."

Had I been consulted in regard to undertaking the responsiblity for a science club of any kind before having this experience, I would have rationalized that the school already has 14 clubs, which are ample; that all the pupils who can find a job in Gardner work in the afternoon or on Saturdays; that the Saturday athletic events cut in on any other; that any pupil who is interested in work of this kind can undertake it supplementary to his regular science courses, et cetera; and that, after all, it is just another thankless task for me.

Birds of prey; a club project

But here I am with the Gardner High School Natural Science Club. If, in August a year ago, I looked upon this enterprise as a big chore, I am willing to admit now that it didn't hurt half as much as I thought it would. I shall go even farther and stand back of the statement that for the leader of a club like this there is a lot of fun to be had.

NATURE THE INVENTOR

(Continued from page 15)

The marrow which fills the bones of mammals is not present in the bones of birds. The walls are also very thin, making them very light. The principle of hollow places in the bones of birds has long been employed by man as a principle in engineering and later in the designs for airplane construction. Steel beams in skyscrapers and bridges are often hollow or molded into a special shape, because science has proved that an amount of material formed into a hollow structure will support much more weight than the same material formed into a solid form. So the success of flight of birds and airplanes can be contributed to the principle of hollow structures of which their framework is constructed. Another principle along this line is streamlining. Birds and fishes have employed this long before man thought of it. In fact, it was only recently that man started to use streamlining extensively.

ONE OF THE early and useful inventions of man is that of paper making. Two thousand years B. C., we find the Egyptians using papyrus reeds, prepared and used as primitive paper. The Chinese are supposed to be the first to use pulp in making paper as early as 150 A. D. The Arabs did much toward papermaking also. Modern paper wood is reduced to a pulp by a sulphite solution. But millions of years ago before man was on this earth, the paper wasp was making paper using the same principle used by man, only the paper was used in making its home. The wasp gets its raw material from decayed wood and changes the wood to pulp by a chemical secretion from the body.

If you have ever become familiar with any medical instruments, you have come in contact with the hypodermic needle

or syringe. This instrument is for the purpose of taking in a quantity of fluid and ejecting it in a stream. Likewise, the poisonous snake has two similar structures called fangs. These fangs are connected with special glands which secrete poisonous venom. The act of striking exerts pressure, forcing the venom out into the wound made by the fangs. Surely medicine has benefited by the example presented by nature which can be successfully copied in this way.

IN THE FIELD of textiles, nature was supreme in invention. The lowly silk worm feeds on the leaves of the mulberry. The caterpillar squeezes out a viscous liquid from its glands which solidifies to a cylindrical thread. With this thread the silk worm builds a cocoon in which it is soon enclosed and protected. Man has learned to use the threads from this cocoon to produce silk fibers. At the present time, as a result of considerable research in this field, man has succeeded in producing artificially what the silk worm did naturally. Today rayon products are in every household. Man's invention is patterned on nature's previous invention.

I hope I have brought to you some of the best of the hundreds of examples which illustrate the fact that nature is truly an inventor. If any of you have ambitions for being an inventor or working along this line, study nature and science well, and you will undoubtedly reach your goal.

VITAMINS ON FISH HOOKS

(Continued from page 21)

than three teaspoonfuls of cod liver oil; and three minims (10 drops or one capsule) of Haliver Oil with Viosterol are equal to not less than three teaspoonfuls of cod liver oil both in vitamin A and in vitamin D units.

TELESCOPE MAKING

(Continued from page 19)

This supports a small flat mirror set at a forty-five degree angle to the plane of the large mirror to catch the light rays from it and bend them into the eyepiece.

The eyepiece is a lens placed at an opening on the side of the telescope tube near the flat mirror and is mounted on what is called a rack and pinion. This is a device for moving the lens back and forth about an inch for the purpose of focusing the image as is done with a miscroscope. The lens may be obtained from an old camera, or just a cheap dime store lens can be used with fair results. If the lens has too long a focal length, additional lenses may be added to the system to shorten the focal length.

MOUNTING the telescope presents another problem. This must be done correctly if all parts of the heavens are to be reached for observation. A three-legged support of sufficient height to allow free movement of the scope is readily designed. On this support there must be two axes. The polar axis is set exactly due north and is placed at an angle to the earth's surface equal to the latitude of the position of the observer. At right angles to the polar axis is the declination axis. The telescope is mounted at the end of this axis. At the other end of the axis is placed a weight to balance the instrument. In the past, cans containing concrete or lead have been used for balancing. The correct arrangement of these two axes makes it possible to follow any of the visible heavenly bodies.

After the telescopes are made, they are used for observing variable stars, meteors, sun spots, and other phenomena of the heavens. Some photographic work is also done with them. Certainly they afford pleasure to their makers and we believe will continue to do so for years to come. We are encouraged in this belief by the fact that several amateur telescope makers are now active members of the Milwaukee Astronomical Society and have made considerable progress in the study of astronomical science.

THE AUTHOR has completed a sixteen millimeter motion picture film and a teachers' guide on "Telescope Making in the West Allis High School." This film may be obtained from the University of Wisconsin Bureau of Visual Education.

We have had some very interesting experiences in the making of the motion picture in that the titles and animated drawings were made by the students and they now have a knowledge of how movies are made, using interior lighting and correct focusing on shots from distances of two to twelve feet away from the object. The film is now being used in schools to introduce the subject of telescope making, and also in the physics classes to introduce the work in light and optics.

The book, "Amateur Telescope Making," published by the Scientific American Company, has been a great help to us in our work and is the most complete edition I have found on this subject.

SANCTITY OF MOLECULE

(Continued from page 22)

we facing chaos instead of order? Decidedly not.

Any thoughtful scientist will agree that vastly more ground has been gained even with ideas which seem revolutionary and disconcerting, than has been lost in the undermining of a traditional theoretical foundation. For contradictory though it may seem, even disorder in the solid state seems to be fascinatingly orderly. For by disorder and variable composition and lattice vacancies soils support and transport nourishment to living plants, storage batteries operate, nonmetallic solids conduct electricity or act as insulators, minerals act as water softeners, valuable alloys exist, iron rusts (unfortunately), cement sets, and a host of other familiar processes occur in the daily life of mankind.

SAFETY EDUCATION

(Continued from page 5)

a gas burner safely? How should safety matches be struck? Do the high school chemistry and domestic science laboratories have fire blankets?

If oxygen is prepared from calcium hypochlorite, opportunity is offered for instruction in safe methods of sterilization of drinking glasses, dishes and silverware, for the hypochlorite finds extensive use in such fields. The close relative, sodium hypochlorite, promotes safety in laundry operations as well as acting as a bleaching agent. Is it understood that the household lye is sodium hydroxide, and because of its corrosive action on tissues should be kept out of reach of children in the home?

ARE THE dangers of carbon monoxide poisoning pressed home to the student and is the tendency of the monoxide to combine with the hemoglobin of the blood to the exclusion of oxygen appreciated by the student?

Has the student been led to see the dangers attending the drinking of surface waters and is he commmunity minded enough to support chlorination of public water supplies?

Does the student understand the extreme care exercised in preparing oxygen for use in hospitals, in the preparation of the various anaesthetics and antiseptics? These and many other questions are to be considered, all to the end that human life may be preserved and human suffering avoided. Surely the chemistry instructor has a rich field for relating his subject to safety measures and thus to daily life.

The time is past when safety instruction can be accomplished by teaching slogans such as "watch your step" and "a careful person is the best safety measure." Safety instruction has passed to the stage where it demands a background of intelligence and there are no school subjects so well prepared to give this body of knowledge as the school sciences.

FUNCTIONAL HEALTH EDUCATION

(Continued from page 2)

which demand the use of the large body muscles.

A SOCIALIZATION program should be organized to enable students to develop desirable social relationships among themselves and with members of the opposite sex. Such a program should include social activities that particular age groups enjoy and so varied that they can learn how to adjust themselves and cooperate with others in many types of activities. Such a program helps the individual to develop a feeling of security in the presence of others and to be both leaders and followers within social groups.

Students in our schools do not lack interest in their own bodies nor in improving their health. Indifference results when they do not understand how their bodies function, why they behave as they do and when teachers begin with a preconceived instructional program foreign to the recognized needs of the students. Instruction to be functional should begin with the basic biological-social interests and needs of the group to be taught.

TRAINING OF A CHEMISTRY TEACHER

(Continued from page 3)

insignificance in comparison to the value of knowing how to attack a problem.

At this point the testimony of no less an educator than John Dewey is worth considering. "One of the only two articles that remain in my creed of life is that the future of our civilization depends on the widening spread and the deepening hold of the scientific habit of mind; and that the problem of problems in our education is therefore how to discover and how to mature and make effective this scientific habit." The years in school cannot possibly give enough material for the whole life even to the most comprehensive mind. If one has learned how to learn quickly and surely, he is fitted for any activity in life.

THE GEIGER COUNTER

(Continued from page 13)

tudes the rays increase, thus proving the point that the rays are probably extra-terrestial. It is also interesting to note that scientists are now working down in Little America with Admiral Byrd.

NOW WE have arrived at the most perplexing problem — where do the rays originate? We will not attempt to answer this question, for the world's greatest scientists and mathematicians have debated upon the subject, and no one as yet has any proof on any one theory. However, the most widely accepted theory is that of Arthur H. Compton who reports:

"The measurements of Milikan and Regener have shown that cosmic rays bring the same amount of heat to the earth as does starlight. None of the attempts to interpret cosmic rays as arising from stellar electric or magnetic fields seem adequate to deliver energy in the required amounts. Although nuclear processes are inadequate to account for the great energies of individual cosmic-ray particles. The evidence now seems to favor the view that the cosmic rays move with our galaxy, are in fact, a part of it, just as are the meteorites. In this case, their origin may be a part of the primeval concentration of matter from which the present world system has developed, or perhaps some process of slow generation of such high energy particles is continually at work within the galaxy."

The great cosmic rays do not come from the earth but originate in the super galaxies beyond the milky way, and someday, somehow, man will master them.

The Gist of It Seems to Be

Abstracts and Reference

FREEDOM, essential for research, has often been crushed in history, and as often has reappeared. Freedom to do research implies the obligation to do thorough and accurate work. Most teachers are not free to do research because they are incompetent in such work. — Otis W. Caldwell, "Some Factors in Freedom for Research," in Sc. Ed., April, 1940. P. B. S.

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A study of the science interests of outstanding elementary teachers seems to indicate that they have even fewer likes for science than do women in general. — Ralph Bedell, "The Science Interests of Successful Elementary Teachers," in Sc. Ed., April, 1940. P. B. S.

* * *

We live in a technological as well as scientific age and courses in technological appreciation should be more widely included in liberal arts colleges. They have been very successful in the one place they have been tried. — John Sanford Peck, "The Place of Technology in General Education," in Sc. Ed., April, 1940. P. B. S.

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An experiment with science lessons on phonograph records and how well they were received. — Harry A. Carpenter, "An Experiment with Recorded Science Lessons," in Sc. Ed., April, 1940. P. B. S.

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A STUDY of some 30 first-class high schools in Missouri shows that these schools are very poorly equipped to do individual laboratory work as recommended. Most of it is by demonstration or in large groups. The demonstration work is very satisfactory. — W. R. Culp, "A Study . . . ," in Sc. Ed., April, 1940. P. B. S.

To teach scientific method and demonstrate present practicality of biology courses we have used a learning habit experiment with a maze and white rats. Interest and results have been very pleasing. — Fletcher J. Proctor, "Objective Animal Experiments," in Am. Biol. Teacher, October, 1940. P. B. S.

* * *

Here is a trick well worth trying — incubating chick embryos in such a way that they are visible throughout the process. — John W. Price and Ernest V. Fowler, "Eggshell Caps . . . ," in Am. Biol. Teacher, October 1940. P. B. S.

* * *

A glowing account of the strength and progress of the American chemical industry closes with a moral note: — " . . . Teachers unduly emphasize subject matter at the expense of the more important ethical and social aim of all teaching, which in my opinion, is to build character. . . . Science teaches the spirit of tolerance, of fair play, and of cooperation. Then why, in certain countries where science is greatly advanced, are not these ideas fulfilled?" — Jas. K. Hunt, "Science and Human Welfare," in S. S. and M., Oct. 1940. P. B. S.

* * *

THE PROPOSED new syllabi for college entrance in physics and in chemistry are published. The emphasis seems to be still almost wholly on subject matter. — The Commission, "Proposed Revision of the Requirements for the College Entrance Examination in Physics," " . . . Chemistry," in S. S. & M., October, 1940. P. B. S.

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How to make a photoelectric sorting and counting device for different colored marbles. — Edw. B. Cooper, "A Photoelectric Sorting and Counting Device," in S. S. & M., Oct. 1940. P. B. S.

BOOK SHELF

Chemistry. Greta Oppe, Ball High School, Galveston, Texas. The Steck Company, Austin, Texas, 1940. 160 pp., 65 illustrations. 45 cents net.

This is a new type of chemistry book — a combination textbook, laboratory manual, and workbook. Each of its eleven units contains some text material, some workbook exercises, a number of laboratory experiments, and a page of review questions, reading references, and suggested activities. The text material will serve as an up-to-date supplement to the content of most chemistry textbooks, for it treats the chemistry of the many new products and techniques that have come out of chemical laboratories during the last few years.

The book, mainly by means of its laboratory worksheets, covers the chemical principles that are included in most high school chemistry courses. In addition, its text, exercises, and some of the laboratory experiments go beyond the usual chemistry manual and bridge the gap between academic chemistry and the everyday interests, experiences, and problems of most high school students.

Illustrations are numerous, and the appearance of the book is very interesting. It opens flat and the laboratory worksheets may be torn out of the book. A set of unit objective tests is inserted loose in the back of each book. A leaflet containing all of the answers for both the book and its tests is provided free of charge to teachers.

Modern Methods and Materials for Teaching Science. Elwood D. Heiss, Teachers College, East Stroudsburg, Pennsylvania; Ellsworth S. Obourn, John Burroughs School, Clayton, Missouri; and C. Wesley Hoffman, Blair Academy, Blairstown, New Jersey. The Macmillan Company, New York, 1940. 351 pages. 25 illustrations. $2.50 list price.

The need for a book to guide the science teacher in better classroom practices, acquaint him with useful equipment, and provide him information as to sources of materials has been met in Modern Methods and Materials for Teaching Science.

The book is divided into three sections. The first of these deals with the principles of science teaching. In it is presented the more recent objectives of science teaching as well as some practical suggestions for organizing and using materials to achieve these objectives. In the chapter dealing with laboratory and demonstrations, arguments are presented to show the value of each and specific suggestions are made for their improvement. The discussion of the evaluation of learning in science is particularly instructive.

The second section deals with the materials and devices for teaching science. In this is included a discussion of the field trip; the use of objects, specimens, models, and pictures; and the manipulation and use of such devices for teaching as the microscope, projection machines, telescope and camera. The information would be quite useful to an inexperienced teacher and to one limited in equipment. Others may well examine this section for suggestions for improving their use of materials.

The third section lists many sources of materials. This is particularly worthwhile for any active teacher. It includes models, exhibits, pictures, charts, posters, and science films.

The book is well written and provides the essential information in a minimum of space.

APPROACHES TO NATURE STUDY

(Continued from page 17)

much interest is required to stimulate boys and girls to go into the study of some special field in which they may take photographs, make observations and jot down notes about what is seen. But there are also ways for increasing interest in the outdoors and many of them are to be used while you are approaching the end and aim of it all. Reading and study should come properly after stimulation and so should be placed at the end of the list of the approaches to nature.

TEACHING WEATHER PREDICTION

(Continued from page 11)

line up on football field and "count off" by twos. Number ones go to center of field and take positions to form the cyclonic whirl. Number twos line up in straight line along the west edge of the field, ten feet apart. When the whistle is blown, number twos advance slowly, in line, and the storm circle moves ahead of them. This drill will need to be repeated until the students in the cyclone have learned how to get around their moving center.

As a final drill, have a student stand somewhere east of the moving storm, and indicate with an arrow held over his head the direction of the wind as the storm edge reaches him, while he is in it, and when he is leaving it.

THESE DRILLS properly done will give a clearer picture of the method of weather prediction than any amount of book, board, or paper work. Bright students may notice some impossibilities in the drill, such as air moving in and never out, as in Drill I, but it should be plain that the "winds" when they reach the center, cannot follow the arrow that "It" is holding, as they should do to be real winds. However, the principles brought out in these drills can be put to practical use as follows:

From the weather page of the New York Times, or from the Weather Bureau reports, obtain the barometric readings for the various cities. Reduce them the nearest tenth of an inch, and present them to the class along with a blank map of the United States showing state boundaries. The class should be able to put in the isobars showing "high" and "low" regions, and to make a fair weather prediction for the following day. Interest is stimulated by comparing student's predictions with Weather Bureau predictions for the same day.

Science teachers will at once see several variations and improvements in this method of teaching weather prediction. The parts that need little variation are the outdoor drills and the actual class prediction of the weather.

INORGANIC CHEMISTRY

(Continued from page 25)

to stabilize plastic sulfur to give materials which will rival any of the substances which the organic chemist has produced? Nitrogen chemistry has given us a solvent, liquid ammonia, which is now one of the cheapest anhydrous solvents available on the market. A chemistry of nitrogen in which nitrogen takes the place of oxygen, has been developed academically and technically. Thus, for instance, the nitrides of boron, silicon, and tantalum are more refractory than the corresponding oxides. In hardness, they may some day rival other abrasive materials. A new acid, sulfamic acid, NH_2SO_3H, a solid anhydrous compound, is now in technical production and it is expected in a few years will be as widely used as acetic, lactic, tartaric and many of the commoner organic acids.

These are but a few of the direction markers which indicate in what fields inorganic chemical research is progressing and advancing at an every increasing pace. These are the signs which point to a renaissance of inorganic chemistry.

NATIONAL DEFENSE

(Continued from page 10)

our armed forces, be again be poured into forced idleness, repeating the errors of the past? Or, will their skill and experience cooperate to produce more and better homes, superhighways, more food, better distribution and better health for all? Science must lead the way. Let us vow that we will train our boys and girls not only in the skills of science, but also in the technique of scientific planning. Not otherwise can we assure a future for democracy in America.

For program of annual meeting of American Science Teachers' Association see page 24.